

NOTES ON AUSTRALIAN CESTODES

BY

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IV. *GYROCOELIA AUSTRALIENSIS*, Johnston

This cestode is evidently fairly common, as it was found in the intestines of several members of the species Spur-winged Plover (*Lobivanellus lobatus*, Lath.) shot in the neighbourhood of Townsville, North Queensland.

EXTERNAL ANATOMY.

Fixed worms measured 167 mm. in length, with a maximum breadth of 4 mm.

The worm is very narrow anteriorly, and widens fairly rapidly and evenly posteriorly. The most striking character is its dorso-ventral diameter, which is very great, especially towards the posterior end. The segments are thick in the centre and thin at the edges, so that in cross section they are bi-convex. The large regularly alternating cirrus, extruded in most mature segments, can be easily made out with the naked eye.

Head. The scolex is flat anteriorly, and measures 0.315 mm. in breadth and 0.22 mm. in length. From the centre of the anterior surface arises a thin rostellum about 120 μ long and 40 μ broad, tapering anteriorly and ending in a bluntly rounded tip; there is very little muscle in this organ. Unfortunately, in all our specimens the hooks had been lost. The four suckers are placed, two on the dorsal and two on the ventral surface of the scolex, and look directly dorsally and ventrally respectively. They are circular in outline, and measure about 130 μ in diameter. Behind the scolex there is no true neck, but a short unsegmented portion of about the same width (fig. 1).

Segments. Segmentation begins at a distance of 4.8 mm. from the anterior end, and about the first ten segments become successively narrower, thus giving rise to the appearance of a neck. The minimum breadth is about 170μ ; from this point the segments progressively increase in width to the posterior extremity.

The dimensions of mature segments are 1.25 mm. across the anterior, and 1.5 mm. across the posterior borders, with a length of 0.8 mm. It is thus apparent that the posterior angles are slightly projecting (figs. 2 and 3).

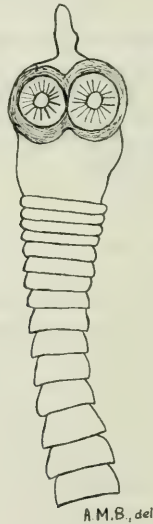


FIG. 1. *G. australiensis*. Scolex and anterior portion of strobila. $\times 56$.

INTERNAL ANATOMY.

Muscular system. In transverse sections the relatively great thickness of the cestode is seen to be due chiefly to the longitudinal muscle fibres, which are arranged in two distinct layers (fig. 4). From without inwards the structures are arranged as follows. First there is the cuticle, which is about 90μ thick, then a layer of transverse muscle, and next to it the outer layer of longitudinal

muscle. This measures about 60μ in thickness, and is composed of oval, discrete bundles of muscle fibre lying with the long axis of the bundles dorso ventral. On the inner surface of this layer is another thin band of transverse muscle, which has on its inner surface the

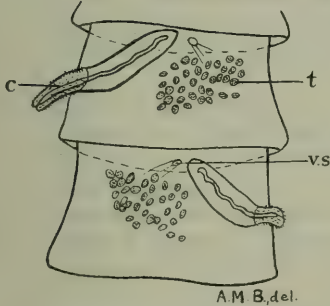


FIG. 2. *G. australiensis*. Young segments showing male genitalia. *c.*, cirrus; *t.*, testes; *v.s.*, vesicula seminalis. $\times 35$.

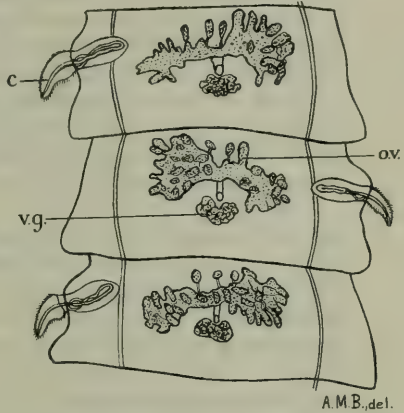


FIG. 3. *G. australiensis*. Older segments showing female genitalia. *c.*, cirrus; *ov.*, ovary; *v.g.*, vitelline glands. $\times 35$.

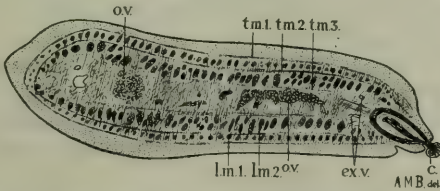


FIG. 4. *G. australiensis*. Transverse section of mature segment. *c.*, cirrus; *ex.v.*, excretory vessels; *lm.1*, outer layer of longitudinal muscle; *lm.2*, inner layer of longitudinal muscle; *ov.*, ovary; *tm.1*, outer layer of transverse muscle; *tm.2*, middle layer of transverse muscle; *tm.3*, inner layer of transverse muscle. $\times 20$.

second and thicker layer of longitudinal muscle. The dorso-ventral diameter is about 140μ in the mid-line, and gradually decreases towards the sides; like the outer layer it is composed of oval bundles of fibres, but in many cases these are broken up into smaller

subsidiary bundles. Dorso-ventral fibres can be made out running between the bundles of longitudinal muscle. On the inner side of the second layer of longitudinal muscle are a few scattered transverse fibres, and these with the two outer layers of the same fibres end in the outer coat of the cirrus pouch where this organ is present.

Nervous system. The main longitudinal nerve is situated well to the outer side of the ventral vessel, and ventral to the cirrus pouch. Further details of this system were not investigated.

Excretory system. The dorsal-lateral excretory vessel is smaller in diameter than the ventral, and lies directly dorsal and close to it, except when the cirrus pouch passes between them, where they become more widely separated.

Testes. The testes are found only in young worms in which there is no trace of the female genitalia, even in the terminal segments. They first appear about the thirtieth segment, and from this point posteriorly they gradually become more developed, and again dwindle, until at about the hundredth segment they have quite disappeared. The testes number about fifty in full development, and measure 45μ on an average. They occupy the central portion of the proglottides (fig. 2).

Vas deferens. The vasa efferentia appear to unite in a small globular structure, evidently a vesicula seminalis, which lies in the anterior of each proglottis, near the middle of the segments and just at the mesial end of the cirrus pouch. They are in no instance conspicuous, and do not appear to function for storing the spermatozoa, except in the earliest stages; as the cirrus develops, the vesicula atrophies and finally disappears. That portion of the vas deferens within the cirrus pouch becomes increasingly coiled as the seminal vesicle atrophies, and it appears to take on the functions of the latter.

Cirrus pouch. The cirrus pouch is a relatively large, thick-walled sac, lying diagonally across the antero-lateral angle of the segments on the pore side, and it opens with absolutely regular alternation on the lateral borders of the segments, slightly in front of the middle. It measures about 450μ long and 150μ broad, and as the worm is at this time only about 1 mm. broad, it is a conspicuous organ. It persists in older worms after the testes are gone and the female glands are well developed; but at this stage

the worms are about 2 mm. broad, and as the cirrus pouch does not increase above the dimensions given previously, its size in relation to that of the proglottides is not so great.

The cirrus is nearly always extruded; it measures about 400μ long and 90μ thick at the base. In the early stages it is a long, fairly thick tubular structure, slowly tapering from base to bluntly rounded tip. Its external surface is thickly covered with backward-curving spines about 4μ long (fig. 2). It runs posteriorly as a rule, and in many cases is recurved, so that the tip points towards the lateral border of the same or the succeeding segment. In worms in which the female genitalia are developed, the cirrus is generally stouter and more conical in shape, and it tapers much more rapidly (fig. 3).

Ovary. The ovaries are only found in older worms. They first appear about the seventy-fifth segment, and have reached full development by about the ninety-fifth segment. In these worms the seventy odd small segments in front of the one in which the ovary is first seen are devoid of all traces of genitalia, either male or female. Apparently therefore, in attaining a certain age, the worms lose their power of developing reproductive organs, any further segments being sterile.

Fully developed ovaries are about 700μ broad and consist of two lobes each composed of lobules running for the most part laterally. The two lobes are united across the mid-line by an isthmus, they are unequal in size, the one on the cirrus side being only about half the size of the one on the opposite side. The result is that they present a regularly alternating asymmetry (fig. 3). In addition, there are three or four small masses of ovarian tissue lying anterior to the isthmus of the gland, and more or less directly connected with it. The ovaries lie across the centre of the proglottides about mid-way between the anterior and posterior borders.

Receptaculum and vagina. Both these structures are absent.

Vitelline glands. The vitelline glands consist of a small horseshoe-shaped mass of tissue, with the concavity facing forwards. They lie in the mid-line behind the ovaries and towards the posterior margin of the segments; ducts can be seen running forwards from their concavities, and these have the follicles of small shell glands grouped around them.

Uterus. The uterus first appears as an oval tubular ring nearly completely surrounding the ovary and vitellarium, which rapidly atrophy (fig. 5). Outpocketings soon appear on the tubular uterus (fig. 6). They become progressively larger and more complicated as development proceeds, until the ring-like structure is nearly lost, and in full development the uterus is represented by a large lobulated sac occupying almost the whole of the proglottides, both laterally and antero-posteriorly (fig. 7).

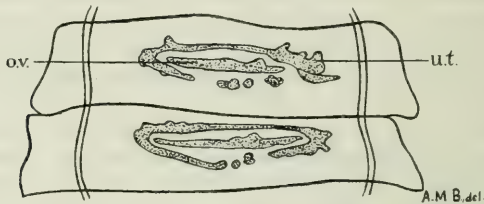


FIG. 5. *G. australiensis*. Segments showing first stage of uterus. *ov.*, ovary undergoing atrophy; *ut.*, uterus. $\times 35$.

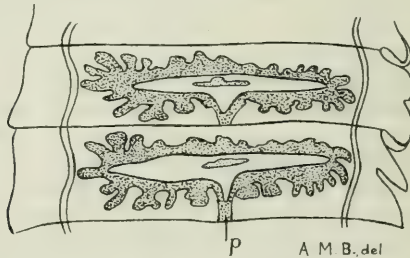


FIG. 6. *G. australiensis*. Segment showing uterus more fully developed. *p.*, uterine pore. $\times 35$.

Another remarkable development is that of uterine pores; these open externally on the centres of the posterior borders of the segments, one on the dorsal and the other on the ventral surface. From examination of horizontal sections, we are of the opinion that these pores arise from a single central opening on the posterior of the uterus, from which two canals run, one to each pore (figs. 6 and 7).

Eggs. The eggs are slightly oval with blunt extremities. They measure about 65μ long and 52μ broad, and the contained embryo, which is enveloped in an albuminous covering, is also oval, and measures about 36μ by 26μ . The hooks on the embryo are about 16μ long.

Fig. 7

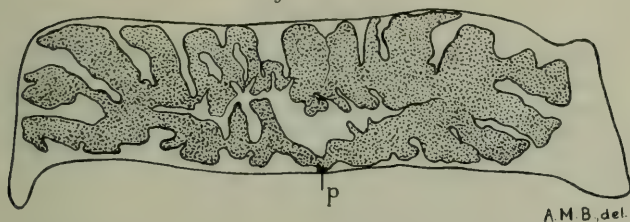


FIG. 7. *G. australiensis*. Fully developed uterus. p., uterine pore. $\times 35$.

DIAGNOSIS.

Although the hooks had been lost from our specimens there seems no reason to doubt that the worm is *Gyrocoelia australiensis*, Johnston. It is, however, necessary to point out that Johnston (1912) figures five minute testes lying immediately anterior to the ovary. Our specimens present a similar appearance, but these structures seem to us to be detached ovarian acini. Further, Johnston (1914) recorded a *Gyrocoelia* sp. from *L. lobatus*, which worm he obtained from the Australian Tropical Institute, the same source as our material, so it is practically certain his unnamed species is also *G. australiensis*.

Clausen (1915), in his description of *G. paradoxa* (von Linstow) (= *Brochocephalus paradoxus*), figures a bi-lobed or double receptaculum seminis enclosed in the uterine ring. Our specimens present a somewhat similar appearance, but the structure is obviously the degenerate ovary and vitellarium.

The occurrence, in our worm, of the male and female sexual organs at different times, which results in a strobila being male when young and female when middle aged, raises the point as to whether

this condition does not likewise exist in the genus *Dioicocestus*, Fühm., 1900, in which case its characters would be limited to the possession of double male genitalia, and an irregularly alternating vagina.

REFERENCES

- CLAUSEN, E. (1915). Recherches Anatom. et Histolog. sur quelques Cestodes d'Oiseaux. Thèse. pp. 63-75. Neuchatel.
- JOHNSTON, T. HARVEY (1912). On a re-examination of Krefft's species of *Cestoda*. *Records of the Aust. Museum*, Vol. LX, No. 1, pp. 28-32.
- (1914). Second report on the *Cestoda* and *Acanthocephala* collected in Queensland. *Annals Trop. Med. & Parasitol.*, Vol. VIII, No. 1, p. 108.